UNITED STATES PATENT APPLICATION

FOR

INCREMENTAL SEAL WIRE ACTIVATION

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INCREMENTAL SEAL WIRE ACTIVATION

FIELD

[0001] The present invention relates to the field of heating circuitry. More particularly, the present invention relates to heat sealing of plastic for consumer and industrial applications.

BACKGROUND

[0002] Consumer products involving vacuuming and sealing plastic bags have grown in popularity over the years. The basic model available includes a seal wire which seals the length of the bag and a vacuum pump which pumps air out of the bag prior to sealing. This model works well enough to have sold and inspired imitation.

[0003] Unfortunately, the model described requires use of expensive components and still suffers from air bubbles in some vacuum-sealed packages. In particular, the seal wire used to seal the plastic is heated throughout its entire length at one time, requiring a high current for activation, and a correspondingly big and expensive transformer. Moreover, the larger the area to be heated, the longer the heating process is likely to take. Similarly, the vacuum must be maintained over a wide physical area (the length of the bag) and may increase the time needed to seal due to any cold air flowing over the area to be sealed.

[0004] Transformers in particular are well-known as expensive components, and their cost increases in a nonlinear fashion, such that a first transformer with

twice the capacity of a second transformer may cost much more than twice the price of the second transformer. Similarly, the bigger the cross-section through which vacuum must be maintained, the larger (and more costly) the pump must be to maintain that vacuum.

[0005] Accordingly, it may be preferable to implement a system in which relatively low-cost components may be used to ease the requirements for a large transformer and a large vacuum pump.

SUMMARY

[0006] An apparatus and method for incremental seal wire activation or incremental sealing in a sealing unit is described and illustrated. In various embodiments, the invention typically includes a method of vacuum-sealing an item such as a plastic bag by sealing a first portion of the bag, vacuuming the bag, and sealing a second portion of the bag under vacuum. The first portion and second portion may have some overlap, such that a part of the bag sealed as part of the first portion may undergo further sealing activity as part of the second portion. Moreover, the sizes and relative locations of the first portion and second portion may be adjustable.

[0007] Alternately, the invention typically includes a first selective electrical connection useful for electrifying a first portion of a heat-sealing strip, a second selective electrical connection useful for electrifying a second portion of a heat-sealing strip, a vacuum pump, and a controller which controls the other

components. The controller may be a simple mechanical controller or an integrated circuit for example.

[0008] In one embodiment, the invention is an apparatus using a first voltage terminal and a second voltage terminal. The apparatus includes a first electrode coupled to the first voltage terminal. The apparatus also includes a second electrode coupled to the second voltage terminal. The apparatus further includes a heating strip having a first end and a second end, the first end coupled to the first voltage terminal, and the second end coupled to the second voltage terminal. The first electrode is selectively connectable to the heating strip at a first intermediate contact, with the first intermediate contact of the heating strip disposed between the first end and the second end. The second electrode is selectively connectable to the heating strip at a second intermediate contact, with the second intermediate contact of the heating strip disposed between the first intermediate contact and the second end.

[0009] In an alternate embodiment, the invention is a method of sealing a seam of a bag. The method includes sealing a first side of the seam utilizing a first configuration. The method further includes vacuuming gases from the bag. The method also includes sensing a vacuum condition responsive to vacuuming the bag. The method further includes shifting to a second configuration. The

method also includes sealing a second side of the seam utilizing the second configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Figure 1A illustrates an embodiment of an apparatus for incremental sealing in a first configuration.

[0011] Figure 1B illustrates an embodiment of an apparatus for incremental sealing in a second configuration.

[0012] Figure 2 illustrates an embodiment of an apparatus for incremental sealing in schematic form.

[0013] Figure 3A illustrates an embodiment of a method of incremental sealing.

[0014] Figure 3B illustrates an embodiment of one method of incremental sealing.

[0015] Figure 3C illustrates an alternative embodiment of a method of incremental sealing.

[0016] Figure 4 illustrates another alternative embodiment of a method of incremental sealing.

[0017] Figure 5A illustrates an alternate embodiment of an apparatus for incremental sealing.

[0018] Figure 5B illustrates the alternate embodiment of an apparatus for incremental sealing in a first configuration.

[0019] Figure 5C illustrates the alternate embodiment of an apparatus for incremental sealing in a second configuration.

[0020] Figure 6 illustrates an overall apparatus including an embodiment of an apparatus for incremental sealing.

[0021] Figure 7 illustrates yet another alternative embodiment of an apparatus for incremental sealing.

DETAILED DESCRIPTION

[0022] An apparatus and method for incremental seal wire activation or incremental sealing in a sealing unit is described and illustrated. The apparatus and method may be used to activate a first portion of a seal wire, then to activate a second portion of a seal wire thereby allowing for fully sealing a plastic bag or other similar container.

[0023] In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the invention. It will be apparent, however, to one skilled in the art that the invention can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the invention.

[0024] In various embodiments, the invention typically includes a method of vacuum-sealing an item such as a plastic bag by sealing a first portion of the bag, vacuuming the bag, and sealing a second portion of the bag under vacuum.

The first portion and second portion may have some overlap, such that a part of the bag sealed as part of the first portion may undergo further sealing activity as part of the second portion. Moreover, the sizes and relative locations of the first portion and second portion may be adjustable.

[0025] Alternately, the invention typically includes a first selective electrical connection useful for electrifying a first portion of a heat-sealing strip, a second selective electrical connection useful for electrifying a second portion of a heat-sealing strip, a vacuum pump, and a controller which controls the other components. The controller may be a simple mechanical controller or an integrated circuit for example.

[0026] In one embodiment, the invention is an apparatus using a first voltage terminal and a second voltage terminal. The apparatus includes a first electrode coupled to the first voltage terminal. The apparatus also includes a second electrode coupled to the second voltage terminal. The apparatus further includes a heating strip having a first end and a second end, the first end coupled to the first voltage terminal, and the second end coupled to the second voltage terminal. The first electrode is selectively connectable to the heating strip at a first intermediate contact, with the first intermediate contact of the heating strip disposed between the first end and the second end. The second electrode is selectively connectable to the heating strip at a second intermediate contact, with the second

intermediate contact of the heating strip disposed between the first intermediate contact and the second end.

[0027] In an alternate embodiment, the invention is a method of sealing a seam of a bag. The method includes sealing a first side of the seam utilizing a first configuration. The method further includes vacuuming gases from the bag. The method also includes sensing a vacuum condition responsive to vacuuming the bag. The method further includes shifting to a second configuration. The method also includes sealing a second side of the seam utilizing the second configuration.

[0028] In one embodiment the method of incremental sealing involves first activating a first portion of a seal wire, then vacuuming ambient air out of an associated plastic bag, then activating the second portion of the seal wire. In an alternate embodiment an apparatus for incremental sealing includes a first electrode and a second electrode both of which are selectively connected to a heating strip and further includes the heating strip which is at one end coupled to a first voltage terminal and at the second end coupled to a second voltage terminal. The first electrode is selectively connectable to the heating strip at a first intermediate contact. The first intermediate contact of the heating strip is disposed between the first end and the second end. The second electrode is also selectively connectable to the heating strip at a second intermediate contact. The second intermediate contact of the heating strip is disposed

between the first intermediate contact and the second end. The present invention provides for the opportunity to seal a first part of the bag, then vacuum out the atmosphere, thereby, potentially achieving a more effective vacuum, and then seal the second part of the bag under vacuum. The present invention potentially allows for use of a smaller or a less current consuming transformer and for use of less maximum current to activate sealing of the plastic bag that is typically used with these devices.

[0029] As is illustrated in Figures 1A and 1B, one embodiment of the apparatus may have a first configuration and a second configuration. The first configuration is illustrated in Figure 1A. Sealing wire 100 has coupled at one end a 0 volt power terminal at point 110 and at another end a 10 volt power terminal at point 120. The 0 volt and 10 volt power terminals may be two terminals of a single power source or supply, for example, and the specific magnitudes of the voltages are exemplary and illustrative of a specific design choice rather than a requirement of the invention.

[0030] At an intermediate point 180 electrode 140 is selectively connected to the sealing wire 100. Electrode 140 is set at 10 volts, through coupling to the 10 volt power terminal. As a result, the portion of sealing wire 100 between point 110 and intermediate point 180 is hot whereas the portion of sealing wire 100 between intermediate point 180 and point 120 is left relatively unheated due to the lack of voltage differential between those two points. Electrode 130 is set at 0 volts and is illustrated as disconnected from sealing wire 100.

[0031] Turning to Figure 1B, intermediate point 190 illustrates the connection point where electrode 130 is selectively connected to sealing wire 100. This generates a hot zone between intermediate point 190 and point 120 due to the voltage differential between those two points. The area between point 110 and intermediate point 190 is left unheated. Note that intermediate points 180 and 190 may be referred to as voltage reception points, where a predetermined voltage is applied to a component such as sealing wire 100.

[0032] The embodiment illustrated in Figure 1A and 1B may be implemented as part of a larger embodiment illustrated in Figure 2. The embodiment of an apparatus for incremental sealing illustrated in Figure 2 includes the two electrodes as described and further includes a mechanism for switching from having one electrode connected to having the electrode connected and a mechanism for sensing whether vacuum is present in the associated vacuum trough of a typical sealing apparatus. Electrode 230 is coupled to swing arm 205 via fastener 210 at one end (or a first end) of swing arm 205. At a second end of swing arm 205 is electrode 240, which is coupled to swing arm 205 through fastener 215 . At the midpoint of swing arm 205 pinion 220 is inserted in a through hole of swing arm 205. Pinion 220 passes through mounting bracket 250 and on the other side is connected to gear 235, such that when gear 235 turns, swing arm 205 rotates and each of electrodes 230 and 240 are moved.

[0033] Gear 235 meshes with the teeth of plunger 245. The first end of plunger 245 includes rubber-sealing ring 265, both of which are inserted into housing

260. Housing 260 may be an annular housing with a large opening on a first end in which the first end of plunger 245 is inserted and a narrow opening on a second end to which hose 270 is connected. Hose 270 is also connected to the vacuum trough of the associated apparatus. Thus, when vacuum is present in the vacuum trough of the associated apparatus, suction through hose 270 draws plunger 245 further into housing 260, thus turning gear 235. Moreover, when air fills the vacuum of the associated vacuum trough, this eases suction against plunger 245, allowing swing arm 205 to return to its normal position. At through hole 285, spring 255 is connected to swing arm 205 and spring 255 is also connected to receptacle 275, which is an attachment on the housing of the associated apparatus. The tension in spring 255 naturally will cause swing arm 205 to return to a position where electrode 240 is in contact with the associated sealing wire absent an opposing force (such as the vacuum pulling plunger 245).

[0034] In some embodiments, it may be useful to control the amount of time during which heating occurs. This can be achieved in a variety of ways. For example, a thermistor or other heat sensing component may be employed to determine when a seal wire or nearby component has reached a predetermined temperature. This determination may either signal heating is complete or that a timer should be started to allow for fusing at a predetermined temperature for a predetermined amount of time. In alternate embodiments, a timer may be employed to cause heating of a sealing strip for a predetermined amount of time without monitoring of an associated temperature. In other alternate

embodiments, a microcontroller may implement timing functions or similar functions and processes for control of heating. Moreover, in yet other alternate embodiments, user activation (such as by pushing or pushing and holding a button for example) may be used to initiate and maintain heating.

[0035] While the apparatuses illustrated in Figures 1A, 1B and 2 can be used for incremental sealing the method of sealing incrementally may also be utilized. Figure 3A illustrates one embodiment of a method of incremental sealing. At block 310 the process is initialized typically by using a first configuration or first state in which a portion of the sealing may occur. At block 320 the first side of the object is sealed. At block 330 vacuum is induced, pulling air out of whatever object is to be sealed. At block 340 this vacuum is sensed. At block 350 responsive to sensing vacuum, a configuration switch occurs such that a second configuration or state is used. At block 360 in the second configuration the second side of the object to be sealed is sealed under vacuum. At block 370 the absence of vacuum is sensed (after the vacuum is filled) and at block 380 the apparatus in question switches back to its original configuration or state.

[0036] This method may be further understood with reference to specific embodiments of the method. For example the embodiment of Figure 3B is related to utilization of shfting electrodes. At block 310a the process is initialized and a first configuration or first state of the apparatus in question is used, with a first electrode connected and a second electrode disconnected. At block 320 the left side of the material to be sealed is sealed. At block 330

vacuum is induced. At block 340 the induced vacuum of block 330 is sensed. At block 350a the electrodes are switched from the first configuration to the second configuration, with the first electrode disconnected and the second electrode connected. As a result at block 360 the right side of the material to be sealed is sealed. At block 370 the absence of vacuum is then sensed and at block 380a the configuration is switched back to the original or first configuration.

[0037] Similarly, Figure 3C illustrates a method related to use of switches. At block 310b the method is initialized typically with a first switch closed and a second switch open in what may be referred to as a first configuration. At block 320 the left side is sealed utilizing current passing through the first switch. At block 330 vacuum is switched on. At block 340 the vacuum of block 330 is sensed. At block 350b a change in configurations occurs, such that switch one is switched off and then switch two is switched on in a break-before-make type of transition. At block 360 the right side is then sealed. At block 370 the lack of vacuum is then sensed and at block 380b the method switches back to the first configuration where switch two is off and switch one is on. As indicated with respect to Figure 3C alternate embodiments of the apparatus may be used.

[0038] Still another alternate embodiment of a method may be employed. Figure 4 illustrates an alternate embodiment of a method of incremental seal activation. In the method illustrated, all sealing occurs under vacuum conditions, and the sealing processes are timed based on predetermined time limits. At block 405, the process is initialized, with associated sealing apparatus in a first

configuration or state. At block 415, vacuum is initiated or pumped down. At block 425, sealing of a first side or first portion of an object to be sealed is commenced. At block 435, the sealing of block 425 is timed until a predetermined time limit is reached. Block 435, in various alternate embodiments, may be replaced with a sensing block wherein deactivation of a seal command (pushbutton for example) from a user is sensed, or with a sensing block wherein a temperature is sensed, resulting in either termination of the sealing or timing of the sealing to a predetermined time limit.

[0039] At block 445, the method includes switching from the first configuration or state to a second configuration or state. At block 455, sealing of the second side or portion (using the second configuration or state) initiates. At block 465, the sealing of block 455 is timed until a predeterined time limit is reached. Block 465 is susceptible to alternative implementations in a similar manner to block 435. At block 475, vacuum pumping stops, after the heating process is expected to have achieved its goals. At block 485, the method involves switching back to an original or first configuration or state.

[0040] In Figure 5A, an alternate embodiment using power MOSFETS is illustrated. Seal wire 500 has a 0 volt connection at endpoint 510 and at a second endpoint 520 a 10 volt connection. Switch 530 is a power MOSFET which is coupled to a 0 volt potential, thereby allowing selective connection of that 0 volt potential to an intermediate point of seal wire 500. Similarly, switch 540 is connected to a second intermediate point of seal wire 500 and is coupled

to a 10 volt potential terminal, thereby allowing for a selective connection of that 10 volt potential to an intermediate point of seal wire 500.

[0041] Figure 5B illustrates a first configuration of the alternate embodiment of an apparatus such as that of Figure 5A. In this instance, switch 540 is closed thereby connecting or allowing the 10 volt potential to be present at the first intermediate point of seal wire 500. Switch 530 is open, thereby allowing for selective connection or disconnection with the 0 volt potential at the second intermediate point of seal wire 500.

[0042] Similarly, Figure 5C illustrates the second configuration of the alternate embodiment in which switch 530 is closed and switch 540 is open thereby allowing for connection of the 0 volt potential to seal wire 500 at the second intermediate point and selective disconnection of the 10 volt potential.

[0043] Turning to Figure 6, an overall system or apparatus in which various embodiments of the invention may be used is illustrated. In particular, Figure 6 illustrates the original first apparatus embodiment in a larger system. Apparatus 600 includes the embodiment of Figure 1 or a similar embodiment along with additional components. Swing arm 605 is coupled at one end through pinion 610 to electrode 630 and at a second end through pinion 615 to electrode 640. A pinion at roughly the center point of swing arm 605, pinion 620, goes through a through hole and supports 650 to gear 635. Support 650 is directly connected to the interior wall of a chamber within device 600 in which all of this material is housed. Thus, gear 635, swing arm 605 and electrodes 630 and 640 are all

supported from device 600. Moreover, when gear 635 rotates, swing arm 605 also rotates. Also connected to swing arm 605 at through hole 685 is spring 655, which is further connected to receptacle 675 of device 600. Spring 655 effectively causes tension to hold in place swing arm 605 in a first configuration.

[0044] Meshed with teeth of gear 635 are teeth of plunger 645. Plunger 645 also has an annular disk 665 such as a rubber ring, both of which are inserted into housing 660 thus providing a relatively sealed connection thereto. Housing 660 has a first end into which plunger 645 is inserted and a second end around which tube 670 is affixed. Tube 670 is further affixed to a first receptacle of vacuum trough 687. Vacuum trough 687 has a second receptacle to which is affixed a second tube 690 which goes to a vacuum pump. Thus, when the pump pumps down to vacuum through tube 690, vacuum trough 687 then effectively pumps air out of tube 670 and plunger 645 is pulled toward the interior of housing 660 thus, causing gear 635 to rotate. When the vacuum is filled in vacuum trough 687, plunger 645 then is naturally moved away by the tension in spring 655 and the resulting rotation of swing arm 605 and gear 635 resets to the first configuration. All of this results in at most one of electrodes 630 and 640 connecting to seal wire 650 at any given time. One end of seal wire 650 is connected to a ground potential, as is electrode 630. The second end of seal wire 650 is connected to a 10 volt potential, as is electrode 640.

[0045] Turning to Figure 7, yet another alternate embodiment of an incremental seal wire apparatus is illustrated. Swing arm 700 is coupled at one end to

electrode 730 through a pinion and at another end to electrode 740 through another pinion. At a middle point swing arm 700 is coupled through yet another pinion or axle to stepper motor 705. Stepper motor 705 may then be activated to turn swing arm 700 the appropriate fractional number of steps to switch from a first configuration with electrode 730 connected to a seal wire, to a second configuration with electrode 740 connected to the seal wire.

[0046] From the foregoing, it will be appreciated that specific embodiments of the invention have been described herein for purposes of illustration, but that various modifications may be made without deviating from the spirit and scope of the invention. In some instances, reference has been made to characteristics likely to be present in various or some embodiments, but these characteristics are also not necessarily limiting on the spirit and scope of the invention. In the illustrations and description, structures have been provided which may be formed or assembled in other ways within the spirit and scope of the invention. Similarly, methods have been illustrated and described as linear processes, but such methods may have operations reordered or implemented in parallel within the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.